EXTINGUISHER CHARGING SYSTEM

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ABSTRACT

A system for vacuum-filling fire extinguishers with a measured charge of discrete fire-retardant material. The system includes a vacuum source and vacuum control means, and one or more reservoirs of fire retardant material. A vacuum and filling conduit means selectively connect the vacuum control means and each reservoir with the extinguisher to be filled, and coupling and sealing means joins said conduit means to the extinguisher in a sealed relationship. Filtering means are also provided to filter the fire-retardant material from the vacuum system.

9 Claims, 4 Drawing Figures
This invention relates to a system for vacuum-filling fire extinguishers with powdered fire-retardant materials. As well-known in the fire-prevention field, standard cylindrical fire extinguishers must be recharged periodically with fresh fire-retardant materials, to maintain the extinguishers in an operative condition. Recharging obviously is also necessary after each extensive use of the extinguisher. Due to these requirements, a substantial industry has developed for providing fire extinguisher users with extinguisher recharging service.

The extinguisher recharging techniques that have been standard in the industry are generally slow, cumbersome and inefficient, and result in substantial labor costs. Generally, the standard recharging is to fill a host of various-sized extinguishers with the desired fire-retardant powder manually through the open orifice provided at the top of the extinguisher. Scoops and funnels are usually employed in an effort to minimize spillage of the powder and speed-up the charging process. These prior techniques have met with only partial success.

Accordingly, the principal purpose of this invention is to provide an improved vacuum-filling system for recharging fire extinguishers which substantially minimizes the labor and time needed to fill a variety of different-sized extinguishers with a selected type of fire-retardant powder. The system in accordance with this invention also substantially reduces the loss of materials during the recharging operation, by providing a closed system for controlling the material flow.

Briefly described, the system in accordance with this invention utilizes a partial vacuum force to fill empty fire extinguisher cylinders with a measured charge of discrete fire retardant material. The system includes a station for receiving an empty and open extinguisher to be recharged. In the preferred arrangement, the station includes a scale for measuring the weight of the material introduced into the extinguisher. A vacuum system including a source of vacuum and a control valve between an opened and a closed position is also provided. One or more reservoirs is included to store the material to be charged into the extinguishers. Vacuum and filling conduit means having movable ends are joined to the vacuum control valve and reservoir respectively. Coupling and sealing means are provided to join the movable ends of the conduit means in sealed relationship to the different-sized orifices of a plurality of extinguishers. Filter means are also provided to filter and collect the material to avoid contamination of the vacuum system. In accordance with this invention the system is arranged so that selective movement of the control valve from a closed to an open position with the conduits secured within a fire extinguisher, draws a partial vacuum within the extinguisher through the vacuum conduit and thereby creates a pressure differential which rapidly draws the fire-retardant material from the reservoir into the extinguisher. In the preferred arrangement the system is provided with a plurality of vacuum and filling conduits which are adapted to feed a plurality of different fire-retardant materials selectively into the fire extinguisher being charged.

Further objects and features of the present invention will become more apparent from the following descrip-
The vacuum system 30 also includes a plurality of suction conduits 60 A–C, connected to the outlet side of the control valves 52 A–C, respectively. The suction conduits 60 A–C include movable ends which permit the conduits to be connected to the extinguisher 100 during the filling operation. Each of the conduits 60 A–C is connected to one of the valves 52 A–C through a filter and collector device 62 A–C. The filters 62 A–C are adapted to filter and collect large particles of the fire-suppressant material which may be drawn into the suction conduits 60 A–C due to the operation of the vacuum-filling system 10. It has been found that a fiber jar-type filter, such as model AB609 y by Gast Manufacturing Co. of Benton Harbor, Mich., is suitable as the filters 62 A–C. 44 and 38. Thus, the filters 62 A–C, combined with the filter 58, protect the vacuum system 30 from contamination by either small or large particles of the powdered material being charged into the extinguishers 100 during the operation of the system in accordance with this invention.

The filling system 10 also includes components which house a readily available supply of fire-suppressant material to be charged into the extinguishers 100 during the filling operation. The system 10 thus is provided with a plurality of material storage reservoirs 70 A–C. As seen in FIG. 1, each of the reservoirs 70 A–C is pivotally mounted upon a suitable frame structure 72 in a position adjacent the filling station 20. Each of the reservoirs 70 A–C includes a removable cover plate 74, to contain the powdered material within the reservoirs during the operation of the system. The covers 74 can be removed from the reservoirs to fill the reservoirs 70 A–C with a supply of the material to be employed in the system 10. The lower ends of the reservoirs 70 A–C define conical discharge hoppers 76 A–C. The hoppers 76 A–C assist the gravity-feed of the powdered material from the reservoirs 70 A–C during the filling operation. Filling conduits 78 A–C are connected to the lower ends of each of the hoppers 76 A–C, and have movable ends adapted to direct the material from each of the reservoirs 78 A–C into the extinguisher 100.
plug 90 will engage, in a sealing relationship, with a plurality of different-sized extinguisher orifices 102. This arrangement is accomplished by selecting the minor diameter 94 to be smaller than the anticipated minimum diameter of the extinguisher orifice 102 and by further selecting the major diameter 92 to be larger than the maximum anticipated diameter for the extinguisher orifice 102. In practice it has been found that a major plug diameter 92 of approximately 3½ inches, and a minor plug diameter 94 of approximately ¾ inches will adapt the plug 90 for sealing within the orifice 102 of a plurality of conventional extinguishers 100 which are encountered in the field.

As clearly seen in FIG. 2, the axis of the conical plug 90 is provided with a bore 96. The upper portion of the bore 96 includes internal threads 98 which mate with the external threads 96 on the union 80, to seal the plug 90 in a fluid-tight arrangement with the union 80. The bore 96 receives the sleeve 82, and also defines an annular path around the sleeve 82 which connects with the vacuum line 60 A-C through the annular path 84 and the suction branch 80B. The plug bore 96 thereby provides paths for the entry of the material from one of the conduits 78 A-C into the extinguisher 100 through the sleeve and for evacuating the interior of the extinguisher 100 through the suction branch 80B.

The operation of the system 10 in accordance with this invention is apparent from the above description. As explained above, the vacuum system 30 operates automatically, through the vacuum switch 46, to maintain a selected vacuum pressure level within the vacuum tank 34. Accordingly, the extinguisher filling operation is started by placing an empty extinguisher 100 on the scale 24 at the filling station 20. Then, the operator of the system 10 selects the type of fire-suppressant material which is to be drawn into the extinguisher 100 from the variety of materials provided in a separate material reservoir 70 A-C. Assuming that the material contained within 70A is to be charged into the extinguisher 100, the operator then inserts the associated plug 90 and union 80 into the orifice 102 of the extinguisher 100. The interface between the extinguisher orifice 102 and plug 90 in this filling position is fully illustrated in FIG. 2. Next, the operator manually moves the control valve 52A from the closed position to the open position, thereby coupling the suction conduit 60A to the vacuum system 30. Upon opening of the control valve 52A, the vacuum pressure within the vacuum system 30 creates a vacuum force to the interior of the extinguisher 100 through the line 60A, the suction branch 80B of the union 80, and the annular path 84. As illustrated by the arrows in FIG. 2, the air entrained within the extinguisher 100 is thereby evacuated from the extinguisher 100 along an upward flow path through the bore 96 in the plug 90. The creation of a vacuum pressure in the interior of the extinguisher 100 also assists in sealing the extinguisher 100 by creating a pressure which draws the plug 90 forcefully downward into firm sealing engagement with the circular orifice 102.

The operation of the extinguisher 100 by operation of the vacuum system 30 creates a differential pressure between the extinguisher 100 and the atmosphere which operates to draw the powdered fire retardant or suppressant material into the extinguisher from the connected material reservoir 70A through the filling conduit 78A. The arrangement of the reservoir 70A and the associated hopper 76A assists the movement of the material from the reservoir 70A by directing the material to the conduit 78A by the force of gravity. The material flows from the reservoir 70A through the filling conduit 78A and the sleeve 82 into the fire extinguisher 100. The extension of the sleeve 82 through the plug bore 96, and into the interior of the extinguisher 100 minimizes the introduction of the powdered material into the vacuum system 30 during the operation of the system 10. The operator holds the control valve 52A open until the scale 24 indicates that the selected amount (e.g., 10 pounds) of material has been charged into the extinguisher 100.

During the operation of the system 10, the air evacuated from the cylinder 100 by the vacuum system 30, including a small amount of entrained powdered material is drawn toward the vacuum system 30 by the negative pressure in the conduit 60A. This air with the entrained material, is passed through the filter 62A so that all larger particles of the material are collected in the filter 62A before the air reaches the valve 52A. The filter 62A is emptied periodically, and the material collected therein is returned to the associated material reservoir 70A. The returning evacuated air from the conduit 60A is filtered a second time by the tank filter 58, to remove any finer particle materials after the air is returned to the vacuum storage tank 34. The dual filtering by the filters 62A and 58 also adapts the system 10 to handle a plurality of fire-suppressant materials having different particle sizes.

When the valve 52 is moved to a closed position, the suction force of the vacuum system 30 is stopped and the filling operation of the extinguisher 100 is completed. The extinguisher 100 is then removed from the filling station 20. The filling operation as described above can be repeated to fill additional extinguishers 100, having a variety of orifice sizes, with any type of material contained within the separate material storage reservoirs 70 A-C. The extinguisher 100 can be filled, in the same manner, with the material from the reservoir 70B by operation of the control valve 52B, and by coupling the free ends of the lines 60B and 78B with the extinguisher 100. Likewise, the extinguisher 100 can be filled with the material from the reservoir 70C by operation of the control valve 52C, and by coupling the lines 60C and 78C to the extinguisher.

Although the invention has been described above with a certain degree of particularity with respect to several embodiments, it should be understood that this disclosure has been made only by way of example. Consequently, numerous changes in the details of construction and in the combination and arrangement of the components as well as the possible modes of utilization for the extinguisher charging system in accordance with this invention will be apparent to those familiar with the art, and may be resorted to without departing from the scope of the invention.

What is claimed is:

1. A system for vacuum-filling a plurality of types of fire extinguishers having varying physical characteristics and requiring differing types of discrete fire retardant powdered material comprising:
   a filling station for receiving a variety of empty fire extinguishers having varying capacities and an open orifice of differing diameters through which the extinguisher is to be filled;
   a vacuum system including a vacuum source;
means providing a plurality of separate sources of different types of discrete fire-retardant material; a plurality of filling conduits each having one end connectable in fluid communication with the discrete material from one of said sources and having a movable end connectable to the open orifice of the extinguisher to be filled at the filling station; a plurality of vacuum conduits each having one end connectable to said vacuum source and having a movable end connectable to the open orifice of the extinguisher to be filled at the filling station; coupling means joining one of said filling conduits to one of said vacuum conduits and adapted to simultaneously connect said coupled conduits with the open orifice of the extinguisher to be filled at said filling station; sealing means joined to each pair of coupled conduits and adapted to seal each of said differing diameter extinguisher orifices from the surrounding atmosphere when said coupled conduits are secured within the orifice; and material selection means for coordinating the type and volume of material discharged from said material sources with the type and capacity of the extinguisher at said filling station, said selection means including multiposition control valve means, arranged to provide each pair of coupled conduits with a valve movable to an opened position coupling the connected vacuum conduit to said vacuum source to create a partial vacuum with the extinguisher secured to said coupled conduit and rapidly flow discrete fire-retardant material from a selected one of said sources into said extinguisher through the coupled filling conduit, said valve in each pair of coupled conduits further being movable to a closed position to stop the flow of said selected discrete material through the coupled filling conduit when said extinguisher at said filling station is filled to capacity.

2. A system in accordance with claim 1 wherein said filling station for receiving an empty fire extinguisher includes weighing means so that operation of said system can be controlled to draw a selected weight of discrete fire-retardant material into the extinguisher.

3. A system in accordance with claim 1 wherein said vacuum system includes a sealed vacuum storage tank, pumping means to maintain a selected vacuum pressure within said tank, and a second vacuum conduit coupling said tank to said control valve means so that said tank provides a continuous vacuum force for filling a plurality of extinguishers successively, and further wherein said system includes a particle filter provided in each of said vacuum conduits to prevent discrete fire-retardant material from entering said vacuum storage tank and pumping means.

4. A system in accordance with claim 1 wherein each material source comprises a storage hopper having a downwardly converging floor section defining an outlet port for said material and wherein said filling conduit is coupled to said outlet port.

5. A system in accordance with claim 1 wherein said sealing means comprises a frusto-conical plug having a major base diameter larger than the maximum orifice diameter of said variety of extinguishers and a minor base diameter smaller than the maximum orifice diameter thereof so that said plug is dimensioned to be received within the varying orifices of a plurality of extinguishers, said plug including a bore defining a flow conduit permitting the evacuation of said extinguishers and the flow of fire-retardant material into said extinguishers through said plug, and further including a resilient exterior conical surface which permits the evacuating of an extinguisher through said conduit to draw said exterior surface into secure sealing engagement with the orifice of the extinguisher being vacuum-filled, and coupling means extending through said bore and defining separate parallel passageways to separately connect the movable ends said vacuum and filling conduits in communication with the interior of the extinguisher.

6. A system for vacuum-filling a plurality of fire extinguishers having varying physical characteristics and requiring differing types of discrete fire-retardant powdered material comprising: a filling station for receiving a variety of empty fire extinguishers having varying capacities and an open orifice of differing diameters through which the extinguisher is to be filled; a vacuum system including a vacuum source; a plurality of separate reservoirs for housing a supply of different types of discrete fire-retardant material; a plurality of filling conduits each having one end connectable in fluid communication with the discrete material in one of said reservoirs and having a movable end connectable to the open orifice of the extinguisher to be filled at the filling station; a plurality of vacuum conduits each having one end connectable to said vacuum source and having a movable end connectable to the open orifice of the extinguisher to be filled at the filling station; coupling means joining one of said filling conduits to one of said vacuum conduits and adapted to simultaneously connect said coupled conduits with the open orifice of the extinguisher to be filled at said filling station; sealing means joined to each pair of coupled filling and vacuum conduits and adapted to seal each of said differing diameter extinguisher orifices from the surrounding atmosphere when said coupled pair of conduits is secured within the orifice; material selection means for coordinating the type and volume of material discharged from said reservoirs with the type and capacity of the extinguisher at said filling station, said selection means including a separate multi-position control valve for each of said vacuum conduits, with each valve movable between an opened position coupling the connected vacuum conduit to said vacuum source and creating a vacuum force in said connected vacuum conduit and a closed position which promptly eliminates said vacuum force in said connected vacuum conduit, so that selective movement of one of said control valves from said closed to said opened position with the coupled vacuum and filling conduits secured within a fire extinguisher orifice, draws a partial vacuum within said extinguisher through said vacuum conduit by means of said vacuum force and thereby creates a pressure differential which rapidly draws discrete fire-retardant material from a selected one of said reservoirs into the extinguisher through the coupled filling conduit, and further wherein the selective movement of one of said control valves from said opened position to said closed position promptly stops the flow of said
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A system in accordance with claim 6 including a plurality of filter means provided in said vacuum system adapted to separately filter and collect said discrete material from each of said vacuum conduits and thereby prevent intermixing of said varying types of said material and contamination of said vacuum source.

A system for selectively vacuum-filling a plurality of types of fire extinguishers having varying physical characteristics and requiring differing types of discrete fire-retardant material comprising:

- a filling station for receiving a variety of empty fire extinguishers having varying capacities and differing open orifice diameters through which the extinguisher is to be filled;
- a vacuum system including a vacuum source;
- means providing a plurality of separate sources of different types of discrete fire-retardant material;
- filling conduit means having one end connectable in fluid communication with the discrete material in one of said material sources and having a movable end;
- vacuum conduit means having one end connectable to said vacuum source and having a movable end;
- with the movable ends of said filling and vacuum conduit means being adapted for simultaneous connection with the open orifice of the extinguisher selected to be filled at said filling station;
- sealing means joined to the movable ends of said filling and vacuum conduit means and sealing each of said differing diameter extinguisher orifices from the surrounding atmosphere when said movable ends of said filling and vacuum conduits are secured within the orifice of an extinguisher at the filling station; and
- selection means for coordinating the type and volume of discrete fire retardant material to be discharged from said sources with the type and physical characteristics of an extinguisher at said filling station which is selected from a group of extinguishers having differing open orifice diameters, said selection means including valve means coupled to said vacuum conduit means and movable between an opened and a closed position with the movement of said valve means into said opened position creating a partial vacuum in the selected extinguisher at said filling station by coupling said extinguisher to said vacuum source through said vacuum conduit means and charging said selected one of said types of discrete fire retardant material into said selected extinguisher from a selected material source through said filling conduit means, and with the movement of said valve means into said closed position coordinating the volume of said selected discrete material charged into said selected extinguisher with the capacity and type of extinguisher being filled through said filling conduit means by selectively reducing the partial vacuum within the extinguisher at said filling station and thereby reducing the flow of the selected discrete material from the selected source through said filling conduit means.

A system for filling fire extinguishers with discrete fire-retardant material in accordance with claim 8 wherein each of said material sources comprises a material reservoir which is readily charged from supply containers of discrete material including a hopper for receiving said discrete material, support means for said hopper, and pivotal connecting means operatively joining said hopper to said frame to align said hopper with a supply container of said material and pivot said hopper and aligned container together with respect to said frame and thereby charge said material to the hopper from the container.

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